Environmental and Natural Areas Management

Environment and Labour

Safe Drinking Water for Public Water Systems: An Overview of a Diligent Approach

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Introduction

This document is a summarized version of our publication *Safe Drinking Water for Public Water Systems: A Diligent Approach.* This summary and the more detailed document are part of Nova Scotia's Drinking Water Strategy to help owners and operators of public water systems understand their roles and responsibilities.

This summary provides basic information to owners of public water systems, municipal councils, boards of commissioners, and operators to help them meet their public responsibilities. It is a guide only. It summarizes the issues that public water system owners may face and the considerations that must guide them in their duties.

What is a Public Water System?

If your water system provides water for human consumption and has 15 or more service connections or regularly serves 25 or more people for at least 60 days per year, it is considered a "Public Water System" under the Water and Wastewater Facility Regulations and Guidelines for Monitoring Public Drinking Water Supplies.

What Regulations Apply to Public Water Systems?

The Nova Scotia *Environment Act*, and its associated regulations, is the principal legislation governing public water systems. It provides for the protection of human health and the prevention of drinking water health hazards through the regulation of drinking water systems and drinking water testing. Some of the regulations that apply to public water systems include:

- Activities Designation Regulations
- Water and Wastewater Facility Regulations
- Guidelines for Monitoring Public Drinking Water Supplies
- Well Construction Regulations

Note that statutes and regulations establish minimum standards of acceptable conduct for the activities they regulate. Both court decisions and the recommendations from the Walkerton and North Battleford Inquiries show that public water system owners must exercise the highest degree of care reasonably possible.

Responsibilities of the Owner

The owner of a public water system is responsible for meeting all of the public responsibilities that apply to the water supply. An owner is a person, municipal council, or board of commissioners who owns a public water system. The owner may designate a manager, operator, or operators to conduct the day-to-day operations of a water supply, but the owner is ultimately responsible for providing safe drinking water and meeting regulatory requirements. To assure that this responsibilities have been carried out diligently, an owner must:

- understand their obligations under the *Environment Act* and associated regulations
- be aware of the conditions outlined in the system's Approval to Operate

- clearly define and understand how councillors, senior management, and other municipal officials exercise diligent decision-making authority over the system
- assign competent and certified operators
- allocate sufficient financial resources for source protection, system operation, and operator training
- require that system operating reports and records be made available upon request to assure the owner that compliance is being achieved
- be satisfied that appropriate steps are taken to address any issues
- complete a System Assessment Report every five years to assure compliance

Responsibilities of the Operator

The operator of a public water system is responsible to assure the system is operated in accordance with all conditions outlined in the Approval to Operate and that all water delivered to customers meets the health-related parameters set out in the Guidelines for Canadian Drinking Water Quality. Public water system managers and operators must assure that:

- all system facilities meet drinking water quality standards
- all system facilities operate in accordance with approval conditions
- all reasonable steps to protect drinking water sources are taken
- records are maintained and submitted to the regulatory agency as required and violations of the Approval to Operate are reported immediately and corrective action taken
- operator certification and training is maintained in accordance with the Water and Wastewater Facility Regulations
- periodic and annual reports on the operations of the public water system are prepared

- any concerns regarding system operations that may compromise water quality or public health are immediately reported to the owner and the steps taken or to be taken to address the issue are documented

Responsibilities of the Province

Nova Scotia Environment and Labour is responsible for:

- approvals - reviews applications and issues approvals with terms and conditions for public water systems
- source water protection - assists in the development of source water protection plans
- operator certification - administers the operator certification program
- lab certification - maintains a listing of laboratories approved to perform drinking water quality analyses
- auditing and inspection - audits and inspects public water systems for compliance
- consultation - provides technical advice and assistance to municipalities and seeks public sector input in the development of standards and regulations
- education - produces educational material to assist stakeholders

What is Due Diligence?

Due diligence means taking every reasonable precaution to the extent of your ability and authority to do so. The degree of diligence required to meet your duty can vary significantly from situation to situation. The "care" you provide must be based on "risk." The greater the risk of harm, the more care, or precautions, that must be taken.

"Drinking water safety is different from general pollution abatement in a number of important respects. First, the public health and safety concerns arising from unsafe drinking water are acute and immediate. If water is contaminated, people get sick or die. As a result, the system must focus on avoiding problems in the first place and on taking swift corrective action when deficiencies are identified."

Commissioner O'Connor, Walkerton Inquiry Part 2 Report, page 68.

In other words, due diligence means taking all reasonable steps to ensure that the system is working. In most cases, it is just good common sense:

- take the time to look at what you are doing
- identify risks
- eliminate the risk if possible
- if the risk cannot be eliminated, set up a system to control, mitigate, or manage the risk
- make sure that the system you have set up is working in practice[1]

Municipalities and other public water system owners must take positive, appropriate steps to:

- identify, understand, and manage environmental risks
- understand the range of environmental regulations and industry-accepted standards
- comply with statutory obligations
- prepare for all foreseeable problems[2]

1 Reg Ferguson, *Due Diligence Handbook* (Hazard Alert Training and Supplies Canada Inc., 2000) at Chapter 2.
2 Dianne Saxe, *Due Diligence and the Environment: Keeping out of Trouble* (OH&S Canada, 1993) at page 2.

Effective Drinking Water Quality Management

The best assurance for clean, safe drinking water is implementing a multiple-barrier approach. The multiple-barrier approach is universally recognized as the most comprehensive method of protecting drinking water quality. Redundancies, or multiple barriers, are put in place so that if one barrier fails, back-up systems and processes prevent or reduce contaminants from making it through the drinking water system. The Nova Scotia Drinking Water Strategy, released in October 2002, is based on the multiple-barrier approach. The strategy outlines the barriers in three broad areas:

- **Keeping Clean Water Clean: Source Water Protection** – preventing contaminants from entering the water in the first place
- **Making It Safe: Treatment and System Operations** – applying management and engineering practices to remove impurities and maintain water quality to the consumer's tap
- **Proving It's Safe: Monitoring and Testing** – establishing programs that allow public water system owners to take immediate corrective actions should problems arise

A properly conducted "System Assessment" will identify the barriers required for a system and will put in place the policies and procedures required to operate and monitor a public water system in a manner that will show due diligence.

What Can Owners and Operators Do?

Given that the safety of drinking water is essential for public health, it is important that you act with a view to ensure protection and safety of users of the public water system. Taking the following actions will help to satisfy your due diligence requirements:

- Characterize your water supply – identify the public health risks and minimize these risks.
- Ensure that adequate and appropriate treatment is in place and that the distribution system is well maintained.
- Ensure that appropriate and adequate operational procedures are in place.
- Require that operators are certified and trained in the operations of your system and that training and certification is an ongoing development that includes succession planning.
- Implement full cost recovery and financing for your water system to assure that the water service is self-sustaining in all aspects of the operation.

Due to the challenges facing small water systems, it is particularly important that they explore all managerial, operational, and technological options to find the most economical way of providing safe drinking water. This can involve regional cooperation and sharing of resources, either through physical connections or management structures.

For example, a non-technical option for improving small system water quality may entail purchasing water from a nearby utility. Management structure options include but are not limited to:

- support assistance – one utility provides support to another utility for services such as operator training, source water protection planning, engineering, and financial planning
- pooling of resources – two or more utilities make joint purchases of supplies to get volume discounts or share the cost of full-time certified operators

- contract service – a third party is contracted to provide specific services such as operation and maintenance, water quality monitoring, billing, or other routine assistance
- regionalization – two or more utilities reach an agreement to form a "service agency" to meet the combined needs of the communities being served

Each of these options has the potential to consolidate some portion of the management and operation of several public water systems within a larger organization, thereby reducing costs to the consumer while maintaining or enhancing water quality.

How Do You Rank?

Your public water system is critical to the health and wealth of your community and should be treated as a valuable resource. Municipal councillors and water utility commissioners may wish to complete the following quiz to evaluate their knowledge of the system.

My System Quiz

Keeping Clean Water Clean
Circle Your Answer

1) Does your water utility have a good source water protection plan?
   ☐ Yes ☐ No

2) Can you:
   a) Name specific risks associated with your type of water supply?
      ☐ Yes ☐ No

   b) If "yes": Are these risks being appropriately managed?
      ☐ Yes ☐ No ☐ Don't Know

Making It Safe

3) Have you toured the water treatment facility?
☐ Yes ☐ No

4) Can you name the major treatment processes and explain their uses?
☐ Yes ☐ No

5) Do you have a financial plan in place to maintain and replace your physical assets, including the distribution system infrastructure?
☐ Yes ☐ No ☐ Don't Know

6) Do you have a record of accurate up-to-date information on the physical assets of your public water system on which to base long-term financial planning for the utility?
☐ Yes ☐ No ☐ Don't Know

7) Are the facility operators properly certified and knowledgeable about the statutory and regulatory requirements imposed on public drinking water systems?
☐ Yes ☐ No ☐ Don't Know

8) Are the facility operators being trained on the importance of proper water treatment to public health, emerging pathogens, and measures to be taken in an emergency?
☐ Yes ☐ No ☐ Don't Know

9) Do you have a continuing education program in place for staff?
☐ Yes ☐ No ☐ Don't Know

10) Does the facility comply with Nova Scotia regulations and standards, as well as industry-accepted standards and practices?
☐ Yes ☐ No ☐ Don't Know

Proving It's Safe

11) Does your water quality monitoring program adequately test the quality of water being consumed by residents and visitors in your community?

☐ Yes ☐ No ☐ Don't Know

12) Do you have a cross-connection program to protect water quality in the distribution system?

☐ Yes ☐ No ☐ Don't Know

13) Do you have a boil-water advisory communications plan?

☐ Yes ☐ No ☐ Don't Know

Did you have more than one "No" or "Don't Know"? If so, you need find out more about your system and what upgrades it needs.

For More Information

For more information about this document or for a copy of the detailed document visit our website at <www.gov.ns.ca/enla/water> or contact:

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PO Box 697
Halifax, NS B3J 2T8
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Fax: 902-424-0501

NOVA SCOTIA
Environment and Labour
Environmental and Natural Areas Management

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Safe Drinking Water for Public Water Systems: A Diligent Approach

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- Ensure appropriate and adequate treatment 9
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Safe Drinking Water for Public Water Systems: A Diligent Approach

Fact: No one wants to be responsible for endangering the health or life of their customers.

Introduction

This handbook provides basic information to help owners and operators of public water systems meet their public responsibilities. It is a guide to the issues that municipalities and other public water system owners may face and to some of the considerations that must guide them in their duties. It should help you to both understand the complex demands of modern environmental statutes and to become informed about industry-accepted standards.

"The standards of due diligence today are high, and have been rising steadily during the past few years."

Dianne Saxe, 1993, page 1

Statutes and regulations establish minimum standards of acceptable conduct for the activities they regulate. Court decisions, and the recommendations from the Walkerton and North Battleford Inquiries, have resulted in the need for municipalities and other public water system owners to show that they exercise the highest degree of care reasonably possible. You can achieve this by meeting all regulatory requirements, applying industry-accepted standards, and taking the steps outlined in this handbook.

This handbook is a guide only. It speaks generally about the public responsibilities that municipalities and other public water system owners may face. It is no substitute for detailed legal and other expert advice. Please refer to expert sources for additional information and guidance.

What Is a Public Water System?

Does your water system provide water for human consumption? Does it have 15 or more service connections or regularly serve 25 or more people per day for at least 60 days per year? If you answer "yes" to these two questions, then you have a "public water system" under the Water and Wastewater Facility Regulations and Guidelines for Monitoring Public Drinking Water Supplies. Water for human consumption means water that is used for drinking, food preparation, bathing, showering, dental hygiene, or dish washing.

Any public water systems must meet the requirements of its Approval to Operate, the Water and Wastewater Facility Regulations, Guidelines for Monitoring Public Drinking Water Supplies, as well as any other requirements under the *Environment Act, Public Utilities Act, Municipal Government Act,* or other applicable legislation. Remember, municipalities and other public water system owners must exercise the highest degree of care reasonably possible to meet the expectations of the public and the courts.

What Regulations Apply to Public Water Systems?

The Nova Scotia *Environment Act* and its associated regulations, is the principal legislation governing public water systems. It provides for the protection of human health and the prevention of drinking water health hazards through the regulation of drinking water systems and drinking water testing.

Some of the regulations associated with the *Environment Act* that apply to public water systems include:

- Activities Designation Regulations - The construction, operation, or reclamation of a municipal water system may proceed only after Nova Scotia Environment and Labour has issued an approval.
- Water and Wastewater Facility Regulations - All municipal water (and wastewater) facilities in Nova Scotia must be classified in accordance with the regulations. In turn, certified operators must operate classified facilities.

In October 2000, Nova Scotia Environment and Labour amended the Water and Wastewater Facility Regulations to:

- require water quality monitoring in accordance with the department's Guidelines for Monitoring Public Water Supplies
- make the health-related guidelines set out in the Guidelines for Canadian Drinking Water Quality legally enforceable standards

The *Guidelines for Monitoring Public Water Supplies* set out the roles and responsibilities of owners, as well as the minimum water quality sampling, testing and monitoring requirements acceptable to Nova Scotia Environment and Labour. Note that water quality monitoring specified in an approval takes precedence over the minimum requirements outlined in the department's Guidelines for Monitoring Public Water Supplies.

- Well Construction Regulations - The installation of new wells and modification of existing wells must be in accordance with the regulations.

The above is only a partial list of regulations that apply to public drinking water systems. A complete listing of regulations by act is available at: <www.gov.ns.ca/just/regulations/regsxact.htm>

Regulations can also be ordered from the Registry of Regulations in hardcopy. Some are also available in electronic format.

Telephone: 902-424-6723
Fax: 902-424-7120
Email: regofregs@gov.ns.ca

System owners must know their legal obligations to meet due diligence requirements.

Responsibilities of the Owner and Operator

The owner of a public water system is accountable for meeting the public responsibilities that apply to the drinking water supply. An owner includes a person who owns, operates, or maintains a public water system, including councillors and commissioners.

Public Water System Owner's Roles and Responsibilities in Providing Safe Drinking Water

- **Meet Drinking Water Standards** - The water supplied by the public water system must meet all health-related drinking water standards. Water quality testing must show that the water quality does not exceed the established maximum acceptable concentration (MAC) or interim maximum acceptable concentration (IMAC) established for the parameters outlined in the Guidelines for Canadian Drinking Water Quality.

- **Notify NSEL Immediately** - The owner of a public water system must immediately notify Nova Scotia Environment and Labour (NSEL) when a water test does not meet an established drinking water standard or when coliform bacteria are detected. The laboratory conducting the water quality test is also responsible to notify NSEL immediately when coliform bacteria are detected.

- **Employ Certified Operator** - It is mandatory that public water systems classified under the Water and Wastewater Facility Regulations be run by certified operators. Operators must be certified by the Province of Nova Scotia.

- **Monitor and Test Routinely** - Public water systems are responsible for all water quality sampling, testing and monitoring requirements. Samples submitted for compliance purposes must be analysed by a certified laboratory.

- **Protect Source Water** - Source water protection involves preventing contamination of your water supply by effectively managing potential sources of pollutants. All municipal public water systems are required to have current and up-to-date source water protection plans in place.

- **Comply with well construction requirements** - Installation of new wells and modifications of existing wells must meet the requirements of the Nova Scotia Well Construction Regulations.

- **Seek Approval to Construct or Operate** - An application, and supporting documentation, must be submitted for a new water system or when upgrades or modifications are made to existing water systems.

- **Keep Records** - Records of water quality results, system assessment reports, etc., must be kept on file by the public water system owner. Records of sample results for microbiological and chemical/physical water quality must be maintained for a minimum of two years and ten years, respectively, from the collection date or as outlined in the Approval to Operate.

- **Report on Water Quality** - All public water systems must provide water quality reports to NSEL upon request or as outlined in the Approval to Operate.

- **Set Adequate Water Rates** - Water utilities must receive sufficient revenues from water rates and other charges to enable them to finance all operating and maintenance expenses and all capital costs including debt service payments. These rates and charges must be approved by the Nova Scotia Utility and Review Board.

- **Conduct System Assessments** - A system assessment report includes a characterization of the water source and a review of the facilities, equipment, operation, maintenance, monitoring, and management of a public water system to verify that the system meets current environmental standards for producing and distributing safe drinking water. Environmental standards are constantly being updated and enhanced. Assessments of municipal public water systems should be conducted every five to ten years to evaluate the capability of the system to consistently and reliably deliver an adequate quantity of safe drinking water to the consumer, and to verify compliance with regulatory requirements.

"What is expected of public utilities commissioners may vary, depending on the size and complexity of the water system for which they are responsible. Under no circumstances, however, can they choose to relinquish their supervisory role and leave all responsibility to senior management."

Commissioner O'Connor, Walkerton Inquiry Part 1 Report, page 222

Although the owner may designate an operator to conduct day-to-day operational and technical activities related to the operation of the public water system, both the owner and the operator are ultimately responsible for providing safe drinking water and meeting regulatory requirements. The owner and operator must work together to ensure that the water system provides safe drinking water.

Responsibilities of the Province

The province, through Nova Scotia Environment and Labour, is responsible for setting standards and guidelines, approving the designation of protected water areas, issuing approvals with terms and conditions for the construction and operation of water treatment and distribution facilities, and auditing compliance with provincial standards. Nova Scotia Environment and Labour also certifies municipal public water system operators and maintains a listing of laboratories approved to conduct drinking water quality analyses for public water systems.

The provincial government develops drinking water policy, collects and compiles relevant information, analyzes trends, develops public education programs, and provides advice to municipalities on technical and financial issues.

Nova Scotia Environment and Labour (NSEL) Roles and Responsibilities in Providing Safe Drinking Water

- **Approvals** - Reviews applications and issues terms and conditions for public water system approvals. Both new water systems and upgrades or modifications to existing water systems require an approval.
- **Source Water Protection** - Staff from NSEL are available to assist with the process of developing a source water protection plan.
- **Operator Certification** - NSEL classifies water and wastewater facilities and administers the operator certification program. To be certified, operators must meet the education, experience, and examination requirements of the program.
- **Lab Certification** - Laboratories that perform water quality analyses for public water systems are required to be approved by NSEL. To be approved by NSEL, a laboratory must be accredited by the Standards Council of Canada or equivalent. Labs must meet specific criteria in order to become certified and must also maintain certification.
- **Auditing and Inspection** - An essential component of NSEL's oversight role for public water systems is its auditing and inspection program. Audits are conducted to verify compliance with terms, conditions, and regulatory standards prescribed in an approval or provincial legislation. Inspections are also conducted if there is a violation or evidence to support a violation.
- **Information and Educational Materials** - Refer to Appendix A for a list of regional offices to contact for drinking water information. Guidance documents on source water protection, treatment standards, operator certification, and municipal approval requirements are available on the web at <www.gov.ns.ca/enla/water/>.

What Is a Diligent Approach?

No public water system can afford to be without a "due diligence" program.

In this time of increasing complexity of water treatment and environmental conditions, and numerous conflicting demands, municipalities and other public water system owners must develop a thorough, well-thought-out system for managing water-related risks and meeting their responsibilities to the public.

A well-designed and well-documented due diligence program has many advantages:

- greater probability of meeting responsibilities to the public and avoiding public health problems
- improved likelihood of meeting or surpassing compliance requirements
- reduced frequency and severity of environmental problems
- increased protection from liability
- improved access to environmental impairment insurance
- better public and employee relations
- improved efficiency, reduced waste, and cost savings

"Due diligence is not, however, easy to achieve. It is a moving target, changing constantly with advances in science, technology, regulatory oversight and public concern."

Dianne Saxe, 1993, page v.

"Continuous improvement" is an important part of a due diligence program. Every day, water suppliers are asked to be better than they were yesterday. To implement the philosophy of continuous improvement, municipalities and other public water systems owners should strive to better or exceed the minimum standards set by regulatory requirements in their day-to-day operations.

A number of tools are available to help staff set goals and targets each year for improving performance and to track improvement throughout the year. A partial listing of available programs is provided in Appendix B.

What Is Due Diligence?

Due diligence means taking every reasonable precaution to the extent of your ability and authority to do so. The degree of diligence required to meet your duty can vary significantly from situation to situation. The 'care' you provide must be based on 'risk.' The greater the risk of harm, the more care, or precautions that must be taken.

In layman's terms, due diligence means taking all reasonable steps to ensure that the system is working.

In most cases, it is just good common sense:

- take the time to look at what you are doing
- identify risks
- eliminate the risk if possible
- if the risk cannot be eliminated, set up a system to control, mitigate, or manage the risk
- make sure that the system you have set up is working in practice

(Source: Ferguson, 2000, Chapter 2)

"The first consideration, however, in choosing any management or operational structure should always be safety." Commissioner O'Connor, Walkerton Inquiry Part 2 Report, page 11

How Much Care Is Required?

Due diligence requires a municipality or other public water system owner to prepare for risks that a "reasonable person" could have foreseen and to provide the associated "reasonable care." To show due diligence, municipalities and other public water system owners must establish an effective system to prevent problems, monitor the results of the system, and improve the system if problems recur.

The best measure of "reasonable care" comes from comparing "what was done" with "what could reasonably have been done." With regard to due diligence, this involves any reasonable alternatives that would have avoided or minimized the harm that the "reasonable person" either knew or ought to have known existed.

Due diligence is not always satisfied by following industry-accepted standards or by simple compliance with legislation. Sometimes the risk of harm is so great that extra precautions must be taken. Municipalities and other public water system owners must take positive, appropriate steps to:

- identify, understand, and manage environmental risks
- understand the range of environmental regulations and industry-accepted standards
- comply with statutory obligations
- prepare for all foreseeable problems (Saxe, 1993, page 2)

Municipalities and other public water system owners are not excused from their responsibilities merely because the precautions are costly. (Saxe, 1990 and 1993)

"Drinking water safety is different from general pollution abatement in a number of important respects. First, the public health and safety concerns arising from unsafe drinking water are acute and immediate. If water is contaminated, people get sick or die. As a result, the system must focus on avoiding problems in the first place and on taking swift corrective action when deficiencies are identified."

Commissioner O'Connor, Walkerton Inquiry Part 2 Report, page 68

Proactive Planning and Management

The best assurance for clean, safe drinking water is the multiple-barrier concept. The multiple-barrier approach is universally recognized as the most comprehensive method for protecting drinking water quality. Redundancies, or multiple barriers, are put in place so that if one barrier fails, there are back-up systems and processes to prevent or reduce contaminants from making it through the drinking water system.

The multiple-barrier concept recognizes that multiple risks require multiple barriers. The Nova Scotia Drinking Water Strategy, released in October 2002, is based on the multiple-barrier approach. The strategy outlines the barriers in three broad areas:

"Keeping clean water clean": Source Protection
means preventing contaminants from entering the drinking water source in the first place, which is better and far less costly than trying to remove them after the fact.

"Making it safe": Water Treatment and System Operation
means applying management practices and engineered technical solutions to remove impurities and maintain quality. Management practices include such things as education, training, and certification. Engineered solutions include construction and treatment standards. Securing the distribution system against the intrusion of contaminants and ensuring an appropriate chlorine residual throughout are also required to deliver safe water.

"Proving it's safe": Monitoring and Testing
means having programs in place that allow public water system owners to monitor and protect water quality from source to tap, as well as to take immediate corrective measures should problems arise. For public water systems, this includes having:

- a comprehensive water quality monitoring program
- continuous monitoring equipment, fitted with warning or automated control devices, where necessary
- well-thought-out standard operating practices for normal operations
- thorough and practised procedures to respond to adverse water quality conditions and emergencies

You can get a copy of the Nova Scotia Drinking Water Strategy on the web at <www.gov.ns.ca/enla/water/>.

"The [multiple-barrier] system is universally recognized as a critical and fundamental tenet for effective drinking water quality management and for ensuring the supply of safe drinking water."

NHMRC/ARMCANZ Co-ordinating Group, [Australian] Framework for Management of Drinking Water Quality, page 21

What Can You Do?

Given that the safety of drinking water is essential for public health, it is important that you act with a view to ensure the protection and safety of users of the public water system. Taking these actions will help satisfy your due diligence requirements.

Characterize you water supply:

All water intended for drinking water should be analysed to identify each parameter that represents a public health risk regardless of whether it comes from a well, a lake, a river, or a brook. The results of this "characterization" are needed to ensure appropriate and adequate treatment to protect public health.

For groundwater supplies, the critical question of whether the supply can be contaminated by surface water must also be answered. It is no longer reasonable to assume groundwater supplies are "secure" — they must be proven to be. Nova Scotia Environment and Labour has developed a protocol for determining if groundwater is under the direct influence of surface water. It is available on the web at <www.gov.ns.ca/enla/water/munich2o.htm>.

"More than a century of experience in public health practice has shown us that prevention is better than cure. These lessons clearly apply to drinking water where we know that, in most cases, source protection measures can prevent problems from developing in the first place."

Dr. Steve Hrudey, Journal of the Australian Water Association, January 2001

Minimize the vulnerability of your supply to contamination:

Preventing contamination of drinking water sources is a standard part of the multiple-barrier approach to providing safe drinking water. It is a collaborative process that depends on the awareness, participation, and actions of local governments, interest groups, individual citizens, and the business community.

Municipalities and other public water system owners must take all reasonable steps to protect drinking water supplies. This includes working cooperatively with adjoining municipalities and/or landowners. If drinking water supplies cross political boundaries, all municipalities have an obligation to help protect them.

Nova Scotia Environment and Labour has prepared guidance documents on how to develop a municipal Source Water Protection Plan. You can get a copy on the web at <www.gov.ns.ca/enla/water/>.

Ensure appropriate and adequate treatment:

There are established minimum treatment requirements for municipal public water systems that use surface water, groundwater, or groundwater that can be contaminated by surface water. The latter is known as "groundwater under the direct influence of surface water". We have developed a protocol for determining if groundwater is under the direct influence of surface water.

The treatment requirements are based on industry-accepted standards for removing and inactivating pathogenic organisms. The treatment requirements for municipal public water systems and the protocol for determining if groundwater is under the direct influence of surface water are available on the web at <www.gov.ns.ca/enla/water/munich2o.htm>.

Municipalities and other public water system owners are responsible for ensuring that appropriate and adequate treatment is in place to provide safe drinking water.

"It is important that water utilities ensure that they have adequate treatment and a capable system to meet the overall objective of providing safe and reliable drinking water."

Dr. Graham Gagnon, Ph.D., P.Eng., Department of Civil Engineering, Dalhousie University, Halifax

Ensure appropriate and adequate operation:

Municipalities and other public water system owners must take every precaution that is reasonable to ensure appropriate and adequate operation of the system to provide safe drinking water. Precautionary measures include but are not limited to:

- establishing policies designed to anticipate and prevent problems
- implementing these policies by establishing lines of authority, reporting mechanisms, and detailed procedures (Swaigen, 1992)

Precautionary measures have personnel, communications, and physical aspects.

Personnel considerations include hiring, training, and supervising qualified staff.

Communications considerations include establishing clear lines and divisions of authority, record-keeping, reporting requirements, and safeguards to ensure information is disseminated to all appropriate individuals.

Physical considerations include the design and layout of the treatment facility and the distribution system, as well as the adequacy of equipment and supplies. Aspects of the system that overlap the physical and communications considerations include maintenance, repair, and timely replacement of equipment and facilities, as well as ensuring the availability of backup equipment and contingency systems should equipment fail. Finally, the owner should adequately inspect and monitor the system to verify that the system is working in practice. (Swaigen, 1992)

In deciding whether or not you are being duly diligent, a court might look at what others in your industry do. Both industry standards and best practices change over time. It is important to remain current and informed. A partial listing of industry-accepted standards and best management practices related to public water systems is provided in Appendix B.

"The record keeping system at the surface water treatment plant was primitive, and in many cases, incomplete. The computer record was often too inconsistent with the manual record to be relied upon. There was no policy in place for internal or external review of the record keeping at the surface water treatment plant."

Commissioner Laing, North Battleford Inquiry Report, page 78

Ensure operator certification and training:
Mandatory certification of operators is an effective measure for assuring continued operational proficiency of water supply facilities, as well as involving operators in the education process. Certification of operators has been mandatory in Nova Scotia since January 1, 1996. Thoroughly trained and qualified operators are essential for the protection of public health and the maintenance of safe and reliable operations of water treatment and distribution facilities.

The Fundamentals
Fundamental requirements include:
- the work team must be competent and capable of carrying out the work safely
- there must be competent leadership
- the correct systems and procedures must be identified and followed. These might include safety policies, rules and procedures, hazards to which the worker may be exposed, and any regulations that apply to the work
- the right equipment to do the work safely must be provided
- adequate communications must be established

(Source: Ferguson, 2000, Chapter 5)

Current environmental standards mean operators of public water systems need to know about:
- applicable statutory and regulatory provisions on drinking water
- emerging pathogens and other contaminants
- importance of treatment and monitoring of drinking water to public health
- measures to be taken in the event of an emergency

Because accepted practice changes rapidly, qualified operators need continuing education to maintain their competence. Certification renewal must be tied to this continuing education.

"I need to accept my responsibility for knowing the expectations and limitations of my facility and the key requirements for providing clean, safe drinking water to all users of the system."

Peter Pothier, Systems Operator, Village of New Minas - Water Commission

Municipalities and other public water system owners should adopt personnel development policies that authorize adequate time and funding for the training of personnel at all levels of the operations.

Ensure adequate cost recovery and financing:
Every water utility should strive to implement the following principles:
- Every water utility should receive sufficient revenues from water service and user charges to enable it to finance all operating, maintenance, and capital costs.
- Every water utility should have a long-term financial plan for maintaining, upgrading, and replacing infrastructure. Fundamental to the success of long-term planning is a record of accurate up-to-date information on the physical assets of each individual water system.
- The cost of service should also include appropriate source protection measures and enforcement, as well as sufficient funding to develop the technical, managerial, and operational expertise and capacity of the water utility.

Financial management, capital finance planning, and rate setting have become critical tasks that demand tried and true financial skills, such as:
- evaluating financial policies and rate impacts
- developing defendable policies that are fair, equitable, and objective
- recovering the full cost of service while still promoting community objectives and getting the rates your utility needs to be successful
- using capital budgets and financial analysis to help avoid rate shocks

Sufficient financial capacity is necessary to invest in people, quality, and sustainable asset management.

The Nova Scotia Utility and Review Board (UARB) has general supervisory power over water utilities and also approves rates, charges, regulations, and establishes depreciation rates. It is critical that water rates and other charges be set to properly fund public water systems and achieve public responsibilities. Contact the UARB for more information on setting water rates:

Nova Scotia Utility and Review Board
PO Box 1692, Unit M
Suite 300, 1601 Lower Water Street
Halifax, NS B3J 3S3
Telephone: 902-424-4448
Fax: 902-429-3919
Email: uarb.board@gov.ns.ca

"A sustainable water system is one that can meet performance requirements over the long term."

US National Research Council in "Safe Water From Every Tap"

Ensuring Small System Sustainability

Small systems generally lack economies of scale, so it may be more expensive, on a per capita basis, for them to meet regulatory requirements. In addition, they may have difficulty attracting, retaining, and affording the expertise they need. (AWWA, 1995)

Small water systems must explore all managerial, operational, and technological options to find the most economical way of providing safe drinking water. This can involve regional cooperation and sharing of resources, either through physical connections or management structures.

Small Water System Challenges

Affordable technologies can help small communities provide better quality water, but technologies alone will not solve the problems of small water supply systems. Without adequate management and revenues, small communities will be unable to maintain even low-cost technologies. Many small communities lack a fee structure that is adequate to generate the necessary operating revenues, let alone funds for capital improvements. In other communities, the population is too small and average incomes are too low to provide sufficient revenue no matter what the fee structure. Lack of revenue leads to a vicious circle: without funding, a water system cannot afford to hire good managers, but without good managers, water systems will have trouble developing a plan to increase revenues.

Source: US National Research Council, "Safe Water From Every Tap"

"The challenge lies not in making small systems safe; technically, this is rarely difficult. Rather, the challenge lies in doing so affordably."

Commissioner O'Connor, Walkerton Inquiry Part 2 Report, page 472

For example, a non-technical option for improving small system water quality may entail purchasing water from a nearby utility. Management structure options can include the following:

- support assistance - one utility provides support to another utility for services such as operator training, source water protection planning, engineering, financial planning
- pooling of resources - two or more utilities make joint purchases of supplies to get volume discounts or share the cost of full-time certified operators
- contract services - a third party is contracted to provide specific services such as operation and maintenance, water quality monitoring, billing, or other routine assistance
- regionalization - two or more utilities reach an agreement to form a "service agency" to meet the combined needs of the communities being served

Each of these options has the potential to consolidate some portion of the management and operation of several public water systems within a larger organization, thereby reducing costs to the consumer while maintaining or enhancing water quality.

How Do You Rank?

This handbook provides some basic information to help you understand the public responsibilities of owning and operating a public water system. The due diligence checklist in Appendix C provides a list of questions that might be relevant in establishing a due diligence program for your public water system.

Your drinking water supply is critical to the health and wealth of your community and should be treated as a valuable resource. Municipal councillors or water utility commissioners may be interested in completing the following quiz to evaluate their knowledge of their system.

My System Quiz

Keeping Clean Water Clean

Check Your Answer

1) Does your water utility have a good source water protection plan?
   ☐ Yes ☐ No ☐ Don't Know

2) Can you:
   a) Name specific risks associated with your type of water supply?
      ☐ Yes ☐ No

   b) If "yes": Are these risks being appropriately managed?
      ☐ Yes ☐ No ☐ Don't Know

Making It Safe

3) Have you toured the water treatment facility?
☐ Yes ☐ No

4) Can you name the major treatment processes and explain their uses?
☐ Yes ☐ No

5) Do you have a financial plan in place to maintain and replace your physical assets, including the distribution system infrastructure?
☐ Yes ☐ No ☐ Don't Know

6) Do you have a record of accurate up-to-date information on the physical assets of your public water system on which to base long-term financial planning for the utility?
☐ Yes ☐ No ☐ Don't Know

7) Are the facility operators properly certified and knowledgeable about the statutory and regulatory requirements imposed on public drinking water systems?
☐ Yes ☐ No ☐ Don't Know

8) Are the facility operators being trained on the importance of proper water treatment to public health, emerging pathogens, and measures to be taken in an emergency?
☐ Yes ☐ No ☐ Don't Know

9) Do you have a continuing education program in place for staff?
☐ Yes ☐ No ☐ Don't Know

10) Does the facility comply with Nova Scotia regulations and standards, as well as industry-accepted standards and practices?
☐ Yes ☐ No ☐ Don't Know

Proving It's Safe

11) Does your water quality monitoring program adequately test the quality of water being consumed by residents and visitors in your community?
☐ Yes ☐ No ☐ Don't Know

12) Do you have a cross-connection program to protect water quality in the distribution system?
☐ Yes ☐ No ☐ Don't Know

13) Do you have a boil water advisory communications plan?
☐ Yes ☐ No ☐ Don't Know

Did you have more than one "No" or "Don't Know"? If so, you need find out more about your system and what upgrades it needs.

Concluding Remarks

Both this document and a summary version were prepared as part of Nova Scotia's Drinking Water Strategy to help owners and operators of public water systems understand their roles and responsibilities. For a copy of these documents visit our website at <www.gov.ns.ca/enla/water> or contact:

Nova Scotia Environment and Labour
PO Box 697
Halifax, NS B3J 2T8
Telephone: 902-424-5300
Fax: 902-424-0501

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Appendix A

Nova Scotia Environment and Labour
Environmental Monitoring & Compliance Division
Regional and District Offices

Northern Region - Truro
P.O. Box 824
Truro NS B2N 5G6
44 Inglis Place, 2nd floor, Suite 3
Truro NS B2N 4B4
Phone: (902) 893-5880
Fax: (902) 893-0282

Northern District - Amherst
32 Church Street
Amherst NS B4H 3A8
Phone: (902) 667-6205
Fax: (902) 667-6214

Northern District - Antigonish
Kirk Place, 219 Main Street, Suite 205
Antigonish NS B2G 2C1
Phone: (902) 863-7389
Fax: (902) 863-7411

Northern District - Pictou
P.O. Box 675 (Middle River Pump Station)
New Glasgow NS B2H 5E7
Phone: (902) 396-4194
Fax: (902) 396-4765

Central Region - Bedford
1595 Bedford Highway, Suite 224
Bedford NS B4A 3Y4
Phone: (902) 424-7773
Fax: (902) 424-0597

Central District - Sheet Harbour
P.O. Box 35
Fire Hall, 22835 Highway #7
Sheet Harbour NS B0J 3B0
Phone: (902) 885-2462
Fax: (902) 885-2743

Eastern Region - Sydney
P.O. Box 714, 295 Charlotte Street
Sydney NS B1P 6H7
Phone: (902) 563-2100
Fax: (902) 563-2387

Eastern District - Port Hawkesbury
400 Reeves Street
Unit 126
Port Hawkesbury NS B9A 2R5
Phone: (902) 625-0791
Fax: (902) 625-3722

Western Region - Kentville
136 Exhibition Street
Kentville NS B4N 4E5
Phone: (902) 679-6088
Fax: (902) 679-6186

Western District - Bridgewater
60 Logan Road
Bridgewater NS B4V 3J8
Phone: (902) 543-4685
Fax: (902) 527-5480

Western District - Middleton
101 Magee Drive
P.O. Box 1000
Middleton NS B0S 1P0
Phone: (902) 825-2123
Fax: (902) 825-4471

Western District - Yarmouth
13 First Street
Yarmouth NS B5A 2S9
Phone: (902) 742-8985
Fax: (902) 742-7796

Appendix B

Industry-Accepted Standards

Recommended Standards for Water Works, 1997
The Great Lakes-Upper Mississippi River Board of Public Health and Environmental Managers in 1950 created a Water Supply Committee consisting of one Associate from each state represented on the Board. A representative from the Province of Ontario was added in 1978. The Committee was assigned the responsibility for reviewing existing water works practices, policies, and procedures, and reporting its findings to the Board. The report of the Water Supply Committee was first published in 1953, and subsequently has been revised and published in 1962, 1968, 1976, 1982, 1987, 1992, and 1997.

The *Recommended Standards for Water Works* document includes the following:

1. Policy Statements - Preceding the standards are policy statements of the Board concerning water works design, practice, or resource protection. Those policy statements, recommending an approach to the investigation of innovative treatment processes, have not been included as part of the standards because sufficient confirmation has not yet been documented to allow the establishment of specific limitations or design parameters.
2. Interim Standards - Following the policy statements are interim standards. The interim standards give design criteria that are currently being used for new treatment processes, but the use of the criteria is limited and insufficient for recognition as a recommended standard.
3. Recommended Standards - the Standards, consisting of proven technology, are intended to serve as a guide in the design and preparation of plans and specifications for public water supply systems, to suggest limiting values for items upon which an evaluation of such plans and specifications may be made by the reviewing authority, and to establish, as far as practicable, uniformity of practice.

The *Recommended Standards for Water Works* are used across North America and are recognized as industry-accepted standards.

Website address: www.hes.org/

AWWA Standards
For more than a century the American Water Works Association (AWWA) has developed consensus standards for products used in the production and supply of safe drinking water. AWWA Standards have earned the confidence of water professionals worldwide. Engineers, manufacturers, and water utilities trust AWWA Standards as their prime reference guides in day-to-day operations to ensure top quality in the products they make and specify. Today, AWWA Standards in print and CD-ROM are the most essential and valued products AWWA offers. In Nova Scotia, the AWWA is represented by the Atlantic Canada Water Works Association (ACWWA), which is a Section of AWWA.

Website address: www.awwa.org/bookstore/

AWWA Manuals
In the day-to-day operation, maintenance, and management of water supply systems, operators and managers alike depend on fast access to basic principles and recommended practices offered by AWWA Manuals of Water Supply Practices. Every AWWA Manual of Water Supply Practices is a consensus document, which means you can be assured that its information is considered as best practices for the industry.

Website address: www.awwa.org/bookstore/

NSF Standards
Since 1944, the National Sanitation Foundation (NSF) has developed standards and provided third-party conformity assessment services for manufacturers/providers of products and systems related to public health, safety, and the environment. The services provided by NSF benefit not only the manufacturers of products, but the regulatory community and consumers/users as well.

NSF has developed and updated over 50 consensus-based standards with the active participation of public health and other regulatory officials, users and industry. The following NSF standards should be of particular interest to public water system owners and operators.

a. Drinking Water Treatment Chemicals and System Components - Health Effects

These standards define requirements for the control of potential adverse human health effects from products added to drinking water directly for treatment or indirectly during storage, transmission, or treatment.

Standards	
ANSI/NSF 60	Drinking Water Treatment Chemicals - Health Effects
ANSI/NSF 61	Drinking Water System Components - Health Effects

b. Drinking Water Treatment Units and Related Products, Components, and Materials

These standards apply to point-of-use and point-of-entry devices designed to reduce specific contaminants from public or private drinking water. These contaminants may include chemical particulate and microbiological parameters that may constitute potential health hazards and/or affect aesthetic quality characteristics. In addition, the standards include requirements for materials and structural integrity.

Standards	
ANSI/NSF 42	Drinking Water Treatment Units - Aesthetic Effects
ANSI/NSF 44	Cation Exchange Water Softeners
ANSI/NSF 53	Drinking Water Treatment Units - Health Effects
ANSI/NSF 55	Ultraviolet Microbiological Water Treatment Systems
ANSI/NSF 58	Reverse Osmosis Drinking Water Treatment Systems
ANSI/NSF 62	Drinking Water Distillation Systems

NSF has numerous other standards covering a myriad of products that municipalities and other public water system owners may be interested in.

Website address: www.nsf.org/

Standards Council of Canada

The Standards Council of Canada (SCC) oversees Canada's National Standards System and represents Canada internationally in standards matters.

The National Standards System includes organizations and individuals involved in voluntary standards development, promotion, and implementation in Canada. Some 15,000 Canadian volunteers contribute to committees that develop national or international standards.

As well, some 270 organizations have been accredited by the Standards Council. Some of these develop standards, others are conformity assessment bodies that determine the compliance of products, services, or systems to a standard's requirements. The list of accredited organizations includes:

- standards development organizations
- certification organizations
- testing and calibration laboratories
- quality management systems (QMS) registration organizations
- environmental management systems (EMS) registration organizations
- QMS and EMS auditor trainers and certifiers

The Standards Council also co-ordinates Canada's contribution to two of the most prominent voluntary international standards development forums—the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC).

Municipalities and other public water system owners should be particularly interested in the SCC partnership agreement with the Canadian Association of Environmental Analytical Laboratories (CAEAL). The granting and maintenance of laboratory accreditation is under the authority of the SCC on the recommendation of CAEAL. CAEAL maintains a complete listing of accredited laboratories while the scope of accreditation for the laboratory is available from the SCC.

Municipalities and other public water system owners must use NSEL approved laboratories to conduct their water quality testing. To be approved, laboratories must be accredited by SCC or equivalent.

Website addresses: www.scc.ca/
www.caeal.ca/

For laboratory accreditation: www.caeal.ca/regions.html/

Optimization

International Water Treatment Alliance
The Alliance is a cooperative effort of the American Water Works Association (AWWA) and water utilities in Canada and Australia dedicated to safe drinking water. It is a program where utilities adopt proven operational and administrative practices designed to improve surface water treatment plant performance. They achieve improved water quality by using flexible technical tools that allow each plant to identify ways to enhance performance that are unique to their own situation.

There are three steps in the Alliance program, namely:
1. Data Collection/Baseline Comparison
2. Self-Assessment/Peer Review
3. Accreditation (preparation)

Each step is intended to assist utilities in progressing toward higher goals for finished water quality. This process gives the water utility the ability to take positive steps to improve water quality.

Website address: www.awwa.org/science/iwta/

QualServe Program

The QualServe utility quality improvements program is a suite of integrated services designed to assist utilities in their quest for excellence. The QualServe program is offered through AWWA and is similar to the Alliance in that it is built upon the concepts of self-assessment, peer review, bench marking, and accreditation. It is a much more comprehensive program, however, in that it covers 20 areas of business process categories. They are arranged into four systems typical to water utilities. The self-assessment and peer review components of the program use these categories to decide where utilities should focus their attention first:

- Organization Development
  - leadership and organization
  - continuous improvement
  - human resource management
  - health and safety management
  - emergency planning and response

- Water Operations
  - water resource management
  - water treatment plant operations and management
  - water distribution/reservoir operations and management
  - water quality management

- Customer Relations
  - customer service
  - customer strategy and satisfaction
  - customer accounts management
  - government, business, and community relations

- Business Operations
  - capital improvement program
  - strategic planning
  - financial and fiscal management
  - engineering
  - information management systems
  - plant and real property management
  - purchasing

Website address: www.awwa.org/science/qualserve/

International Standards Organization

The ISO has developed an international accredited standard ISO14001 to provide a generic framework for guidance on the development and implementation of an environmental management system (EMS) to minimize the impacts of business operations on the environment and to foster environmental sustainability.

Website address: www.iso.ch/

Hazard Analysis and Critical Control Point (HACCP) System

HACCP is a systematic and preventive approach to achieve food safety standards. Originally developed in the United States to guarantee the safety of astronauts' food in space, HACCP is now being adopted worldwide as a scientific, straightforward and effective approach to enhance food safety. HACCP is increasingly being used in the water industry to address everything from routine contamination to security issues.

The World Health Organization (WHO) *Guidelines for Drinking Water Quality* follow key elements of HACCP for improving water process control through the use of risk assessment and quality management tools. This HACCP-based approach is used in several European countries. HACCP has also been used extensively in Australia where currently six utilities have formally registered HACCP systems.

The HACCP approach is based on seven principles aimed at identifying hazards, controlling hazards at critical control points in the process, and verifying that the system is working properly (e.g. due diligence program). The key element of the HACCP system is its preventive nature meaning that potential safety hazards are controlled throughout the process. The seven basic principles of HACCP are:

1. Identify the hazards and list preventive measures to control them.
2. Determine the critical control points.
3. Establish limits at each critical control point.
4. Establish procedures to monitor the critical control points.
5. Establish corrective action to be taken in case of a deviation.
6. Establish procedures to verify that the systems are working correctly.
7. Establish effective record keeping.

Hazard analysis (HA) - is the first principle and starting point of HACCP. Hazards can arise at any stage of production, from source, through treatment and on through distribution. Proper identification and analysis of hazards are central to the hazard analysis process. Hazards may vary from one system to another due to differences in the source, equipment, plant layout, preparation, etc.

Critical Control Point (CCP) - is a point or step in the process at which control can be applied and a hazard can be prevented, eliminated or reduced to an acceptable level. Determining CCPs required to control identified hazards is the second major principle of HACCP. CCPs are located at any point in the process where microbiological, physical and chemical hazards can be eliminated or controlled. It is very important that CCPs are developed and documented carefully. The success of controlling hazards depends on the care taken in determining the CCPs, the critical limits that must be met at each point, the monitoring procedures used to control each CCP and the corrective action taken when there is a deviation identified at a CCP. Verification of each CCP will ensure that monitoring procedures are in place and are effective in controlling the potential hazard.

Best Management Practices

National Guide to Sustainable Municipal Infrastructure

In 2001, the federal government through its Infrastructure Canada Program (IC) and the National Research Council (NRC) joined forces with the Federation of Canadian Municipalities (FCM) to create the National Guide to Sustainable Municipal Infrastructure. The Guide is both a new, national network of people and a growing collection of published best practice reports for use by decision-makers and technical personnel in the public and private sectors. Based on Canadian experience and research, the reports set out the best practices to support sustainable municipal infrastructure decisions and actions to six key areas: (1) municipal roads and sidewalks; (2) potable water; (3) storm and wastewater; (4) decision making and investment planning; (5) environmental protocols; and (6) transit.

Its creation is made possible through $12.5 million from Infrastructure Canada, in-kind contributions, technical resources, the collaborative effort of municipal practitioners, researchers and other experts, and a host of volunteers throughout the country. By gathering and synthesizing the best Canadian experience and knowledge, the Guide helps municipalities get the maximum return on every dollar they spend on infrastructure—while being mindful of the social and environmental implications of their decisions.

The best practices are free of charge and available on-line and in hard copy.

Website address: www.infraguide.gc.ca/best.html/

AWWA Policies and White Papers

The American Water Works Association has developed numerous policies and white papers on public water supply matters to promote the provision of the best water service to the public. AWWA policy statements are used to explain the association's position on a variety of issues important to the association and its membership. Association white papers are more extensive discussions focused on major issues affecting water supplies and their customers. The association has developed 28 polices and 16 white papers.

Website address:
www.awwa.org/about/oandc/officialdocs/awwastat.cfm/ (policies)
www.awwa.org/advocacy/govtaff/govpol.cfm/ (white papers)

Appendix C

Due Diligence Checklist

Reproduced by permission of Carswell, a Division of Thomson Canada Limited.

The following are some questions that might be relevant in establishing a program to prevent offences and in determining whether due diligence was exercised in the case of an equipment failure resulting in harm to a worker, damage to property, pollution or some other failure to comply with a legal duty.

Equipment

- Was the equipment in place? If not, why not?
- Was it designed to accomplish the purpose it was being put to? For example, did it have adequate capacity? Had the type or rate of production changed since the equipment was installed, so that more, larger, or different type of equipment was needed?
- Was it properly installed?
- Were replacement parts on hand?
- Was back up equipment needed, and if so, was it available (for example, a spare pump)?
- Was the equipment dedicated to a specific purpose or was it used for several different purposes that increased the risk of failure, or of harm should failure occur?

Operation

- Was the equipment operational, or had it been installed but never used?
- If operational, was the equipment running and if not, why not?
- If it was running, was it doing its job?

Maintenance

- How old was the equipment?
- When was it purchased, and from whom?
- Did the supplier provide a maintenance manual, and if not did the company create its own manual?
- Was a warranty provided, and if so, for how long?
- How long is this equipment designed to last? In practice, does it usually last longer than its design life, or wear out more quickly?
- Was there a maintenance schedule, and if so, did it provide for inspection, cleaning, and repairs frequently enough and did the company adhere to it?
- Did the equipment show obvious signs of wear and tear? If so, had the company put its mind to the significance of these signs, and what conclusions were drawn? Were the signs observed by workers? By inspectors? If so, were they reported to management? Did a maintenance log exist? Were entries made regularly or sporadically? Were these observations recorded in a maintenance log?

- Who was responsible for maintenance and were they properly trained and equipped to carry out maintenance effectively?
- Were remedial actions recommended and carried out?

Repairs

- When was the equipment last repaired?
- What were the qualifications and experience of the repairman?
- How frequently had it broken down before?
- Were previous repairs recorded?
- Does the company cease production while doing such repairs, or try to maintain production during repairs? If the latter, does this increase the risk of harm that occurred?
- After completing maintenance or repairs, does the company check all systems to ensure that they are still operating properly before putting the equipment into use again?

Timely Replacement

- When was the equipment purchased?
- What was its life expectancy?
- Were there any warnings by the manufacturer, distributor, sales people, or workers that the equipment needed to be replaced?

Backup Systems and Backup Equipment

- Were there alarms to warn if equipment failed to perform its function? Were these alarms hooked up? Were they in working order?
- Was the emergency response equipment in place? Was it adequate for the nature of the accident or emergency that occurred?
- Were personnel trained in emergency response? Was there an emergency response manual?

Personnel

- What was the education and work experience of the staff?
- What training were they given? For how long? Were the trainers qualified to give this training?
- Was there a specific person dedicated to functions that would have prevented the violation, or was the function shared among many members of the staff?
- What priority was given to the functions of properly operating, maintaining, repairing, and replacing the equipment in question, in relation to staff members' other duties?

Supervision

- On what shift did the breakdown occur? If on the night shift, was there only skeleton staff on that shift? Were there any management personnel on duty, or only workers?
- Were written instructions given to cover off foreseeable situations that might lead to exceedence. Were these instructions understood by the workers? If not, what was the reason for the misunderstanding?
- In the past, had sanctions been imposed on workers who ignored instructions, or was there a tacit understanding that despite formal procedures, these instructions were not binding?

Communications

- Were production, maintenance, and repair logs keep?
- Were they passed on to each new shift?
- Were entries kept regularly, or sporadically? Were they legible?
- Were the records from the previous shift reviewed by the incoming shift?
- Did the logs contain gaps that required explanation? If so, what is the explanation?
- Were these logs available to all who need to know what is in them?
- Was there a requirement to report unusual occurrences, equipment breakdown, material shortages, violations of laws, spills, etc. to the appropriate personnel in the appropriate departments?
- If subordinates were responsible for reporting the violation to authorities, did they first need management approval? If so, did this delay reporting?
- What were the lines of communication from department to department and between superiors and subordinates and between company personnel and regulatory authorities?
- Were reporting requirements posted? Were they placed in an appropriate policy or procedures manual? Was it clear who was to report, and who was to receive the report?
- Were the names and addresses and telephone numbers up to date?
- Did the policy state clearly what was to be done under various circumstances?
- Had the rules been clearly communicated to and understood by everyone who needed to know?

Source: *Regulatory Offences in Canada*, Pages 237–40. Canadian Institute for Environmental Law & Policy and John Swaigen, 1992. Carswell.
ISBN: 0-459-55665-7.

NOVA SCOTIA

Environment and Labour

Environmental and Natural Areas Management